A PROSPECTIVE STUDY ON

SPLENIC INJURY

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CERTIFICATE

This is to certify that, this dissertation entitled **"A PROSPECTIVE STUDY ON SPLENIC INJURY"** submitted by **Dr. K.RAJARAJESWARI** to The Tamil Nadu Dr. M.G.R. Medical University, Chennai is in partial fulfillment of the requirement for the award of M.S. degree Branch I (General Surgery) and is a bonafide research work carried out by her under direct supervision and guidance.

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DECLARATION

I, **Dr. K. RAJARAJESWARI**, solemenly declare that the dissertation titled **"A PROSPECTIVE STUDY ON SPLENIC INJURY"** was done by me at K.A.P.V. Government Medical College, Trichy under the guidance & supervision of the Head of Department & Prof. of Surgery **Dr. A. KANAGASUNDARRAM M.S.** This dissertation is submitted to the Tamil Nadu Dr. M.G.R. Medical University Chennai, in partial fulfillment of the requirement for the award of MS degree in General Surgery.

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INTRODUCTION

An injured spleen is a well-known entity to those involved in trauma care. The majority of individual with a splenic injury now receive nonoperative intervention and therapy. This shift from operative to nonoperative treatment over the past several decades is a tremendous success story in which clinical judgment and reason triumphed over standard surgical dogma.

Furthermore, this success has prompted surgeons to adopt similar management strategies for other solid organ injuries. Recent work with clinical outcomes data in splenic trauma has given rise to model clinical practice guidelines. These guidelines serve to standardize and justify management decisions based on the best possible data and accepted clinical parameters

AIM OF THE STUDY

The aim of the study is to evaluate the following aspects :

1. To evaluate the impact of blunt or penetrating abdominal trauma on spleen
2. To evaluate various modes of injury.
3. To evaluate various modes of clinical presentation of cases .
4. To evaluate the value of various available investigations employed
5. To evaluate the various methods of treatment .
6. To evaluate various associated injuries occurring .
7. To evaluate the morbidity and mortality .

MECHANISM OF INJURY

Splenic injury most commonly occurs following blunt trauma due to motor vehicle collisions (driver, passenger, or pedestrian). However, blunt splenic injury can also result from falls, sport-related activities, or assault. Penetrating splenic trauma is less common than blunt injury and is typically due to assault, but inadvertent impalement may also occur. Assault with a knife compared with gunshot or shotgun wounds is less likely to result in penetrating injury due to the spleen's protected location.

Several pathophysiological mechanisms can occur in patients with blunt abdominal trauma . A sudden and pronounced rise in intra-abdominal pressure created by outward forces can rupture a viscus. Passengers wearing a lap-belt without a shoulder attachment can sustain injury from such a mechanism when the belt forcefully compresses the abdomen.

RESUSCITATION AND EVALUATION OF PATIENT

Resuscitation:

In emergency room restoration of airway, mechanics of breathing and circulation should be focused on .Airway manoeuvres such as endotracheal intubation are required only in patients with ventilatory problems after thoraco-abdominal wounds, severe abdominal wounds in moribund state or cardiopulmonary arrest. Intravenous lines is introduced to restore circulating volume. If patient is in hypotension, 2 to 3 L of crystalloid solution should be given. If still in hypotension, blood is to be transfused .

Nasogastric tube is helpful in both evaluation and resuscitation. It reduces contamination of peritoneum, eliminates acute gastric dilatation, reduces the incidence of preoperative aspiration and avoids injury during diagnostic peritoneal lavage. Bladder should be catheterized.

Evaluation :

Clinical manifestation - A careful history is the most important one. In motor vehical accident, it is imperative to know whether rapid deceleration occurred, whether the patient weared restraint device and the

type of restraint. On physical examination, the most frequent signs are hypotension and peritonitis. On inspection of abdomen, every external injury should be noted. Abdomen distension is noted . On palpation signs of peritonitis, guarding , rigidity and rebound tenderness may be present.

DIAGNOSTIC MODALITIES

Diagnostic peritoneal lavage (DPL) has historically been the cornerstone diagnostic study used to detect significant intraperitoneal injury requiring surgical intervention. This quick, simple procedure can be easily performed in the resuscitation area of the emergency department. DPL is considered to be positive for the presence of significant intraperitoneal injury when more than 10 ml of gross blood is aspirated directly from the peritoneal cavity or when the returned effluent contains more than one lakh per cubic mm of red blood cells, more than five hundred per cubic mm of white blood cells, or demonstrable bacteria or bile .

In cases of significant splenic trauma, the most common findings on DPL are either the return of gross blood or the presence of more than 100,000/mm^3 of red blood corpuscles. The sensitivity of DPL for detecting significant intra-abdominal injury has been reported to range from 82% to 96%, whereas its specificity ranges from 87% to 99%.[5]

Despite this, it has been reported that between 25% and 36% of celiotomies performed solely on the basis of a positive DPL are negative. Moreover, DPL itself carries an incidence of complications approaching 2.5%.[6,7] Because of the inherent inaccuracies of DPL, as well as its invasiveness, this diagnostic modality has now largely been supplimented by the use of noninvasive imaging studies such as ultrasound and computed tomography (CT).

Ultrasonography

It is readily available, can be performed quickly, and offers a completely noninvasive method for rapidly surveying for intraperitoneal blood or solid organ injury in patients with blunt or penetrating abdominal trauma. The focused abdominal sonography in trauma (FAST) examination, though somewhat lacking in specificity, is nevertheless highly sensitive for detecting intraperitoneal blood—a frequent accompaniment to significant splenic trauma—and has emerged as a useful diagnostic tool in the evaluation of patients with suspected splenic injury.

FAST is completely without risk of complications and, moreover, its performance does not preclude the subsequent performance of CT scanning. The sensitivity of FAST has been reported as anywhere

between 42% and 93%, whereas its specificity ranges in various reports between 90% and 98%.[8] The primary limitations of FAST (and, no doubt, the reasons for the extraordinary variability of the reported sensitivity of this technique) are :

(1) the heavy operator dependence of ultrasonographic examinations

(2) the obscuring effect of intestinal gas, which can severely compromise the ability to obtain distinct and useful images.

Although FAST has not emerged as the dominant diagnostic imaging modality in the evaluation and management of patients with abdominal trauma, it has proved useful as a preliminary study, helpful in guiding the performance of additional imaging studies (e.g., CT) to determine the need for surgical management.

CT scanning

It is the diagnostic imaging modality of choice in all hemo dynamically stable patients in whom splenic injury is suspected. The sensitivity and specificity of CT scanning (approaching 100% and 98%, respectively)[9] are superior to both FAST and DPL in detecting significant intra-abdominal injury and determining the need for surgery. Moreover, the exceptional resolution afforded by current-generation multislice scanners provides extraordinary detail regarding specific intra-

abdominal organs and retroperitoneal structures. CT allows detailed examination of the splenic architecture, enabling the differentiation of simple subcapsular hematomas from more significant intraparenchymal hematomas, splenic fractures, and massive crush injury involving the entire spleen.

To maximize the diagnostic accuracy of CT, patients should be given both intravenous and oral contrast to enhance tissue definition. Another advantage of CT scanning is that studies are performed according to predetermined computer-guided protocols, eliminating dependence on individual operator ability.

Disadvantages of CT include the administration of ionizing radiation, the potential for nephrotoxic or anaphylactic reactions to the contrast agent, and the time required to transport patients to the scanner and to perform the examination. This latter consideration accounts for the inapplicability of CT scanning in hemodynamically unstable patients. However, the ubiquity of CT scanners, their proximity to the trauma area in well-designed modern emergency departments, and the astonishingly rapid image acquisition times with the newest generation scanning units all are factors continually extending the applicability of CT for evaluation of all but the most unstable patients.

CT SCORING SYSTEM FOR SPLENIC TRAUMA

* Resciniti et al described a CT scoring system for splenic trauma regarding the management. It is as follows:

* Splenic parenchyma

  0- splenic parenchyma is Intact

  1- Laceration (linear ,thin defect)

  2-Fracture (irregular and thick defect)

  3-parenchyma completely shattered

* Splenic capsule

  0- splenic capsule is Intact

  1- Perisplenic fluid present

* Abdominal fluid

  0-No abdominal fluid

  1-Any abdominal fluid except perisplenic collection

* Pelvic fluid

  0-No pelvic fluid

  1-Presence of pelvic fluid

* In adult , with a total CT score of < 2.5, nonsurgical treatment was successful .

* A score greater than or equal to 2.5 (46% Successful) surgical treatment.

* A subsequent study elucidated potential errors of the scoring system, particularly in discriminating subcapsular from perisplenic fluid and accounting for interobserver variability (umlas, 1991).

However, 12 of 15 patients treated nonsurgically who had a score of less than 2.5 had favorable outcomes.

* Despite the criticisms, overall conservative treatment failed in only 2 (10%) of 21 patients. This result represents a significant improvement over the 22 – 75 % failure rates reported in the literature.

Obviously, the scoring system created by Resciniti is imperfect, and further evaluation is needed.

* Initial reports telling conservative treatment for blunt splenic trauma found that a patient age more than 55 years is an indicator of poor outcome (Godley, 1996; Elmore, 1989; Longo, 1989; Smith, 1994;). Addition of patient age to the scoring system would improve results.

Thus apart from clinical examination, investigations like diagnostic peritoneal lavage, ultrasound , CT scanning all play important role to decide finally whether the patient can be managed only by surgery or even by spleen salvage procedures or by conservative measures.

REVIEW OF ANATOMY

The **spleen** is wedge shaped organ situated in the left hypochondrium, and partly i.e its superior portion in the epigastrium.It is wedged in between the fundus of the stomach and diaphragm. It is the largest of the ductless glands , a lymphatic organ connected to the vascular system. It is highly vascular, acts as a filter for blood and of a dark purplish in color. Sometimes the spleen is tetrahedral in shape.

Development

The spleen develops in the cephalic part of dorsal mesogastrium, from its left layer, during sixth week of intrauterine life into a number of nodules which fuse to form a lobulated structure. Due to change in the position of the stomach, spleen is carried to the left, and comes to lie behind the stomach and in contact with left kidney. Notching of the superior border of spleen is an evidence of its multiple origin. These nodules which fail to fuse, form accessory spleens which may be found in the derivatives of dorsal mesogastrium ie lienorenal ligament, gastrosplenic ligament, gastrophrenic and greater omentum or in the broad ligament of uterus or in the spermatic cord.

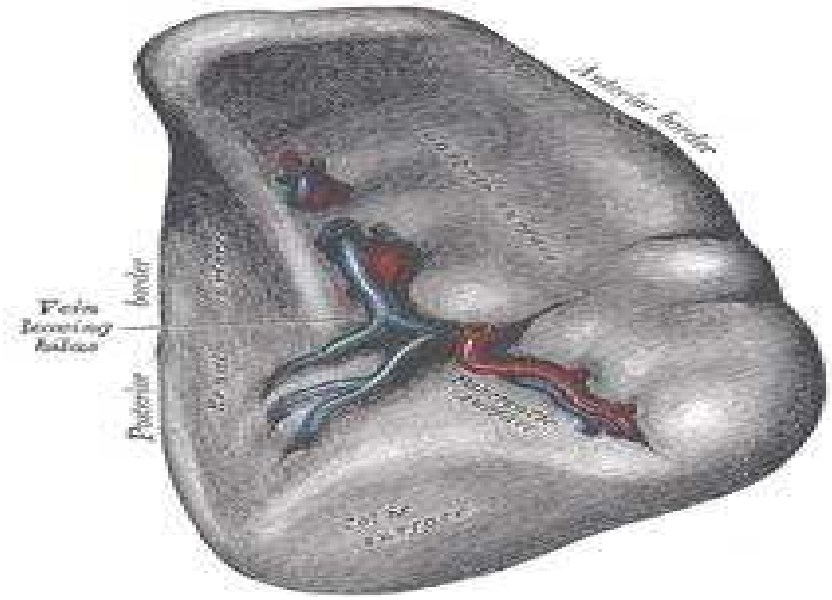
Relations

The (*facies diaphragmatica; phrenic or external surface*) **diaphragmatic surface** is smooth , convex and is directed backward, upward & to the left. But at its upper end, it is directed slightly medialward. It is related to the under surface of the diaphragm, which separates it from the 9, 10 , 11 ribs of the left side, and intervening lower border of left lung and pleura.

Visceral surface of the spleen

It is divided by a ridge into an gastric or anterior and a renal or posterior portion**.**

The **gastric** (*facies gastrica*) **surface**, which is directed upward, forward, and medialward, is concave and broad , and is in contact with posterior wall of the stomach, below with the tail of the pancreas. It presents near its medial border a long fissure called as the hilum. This is pierced by several irregular openings, for the entrance and exit of nerves and vessels.



The **renal** (*facies renalis*) surface is directed downward and medialward. It is somewhat flattened and is considerably narrower than gastric surface, and is in relation with upper part of the anterior surface of the left kidney and sometimes with the left suprarenal gland.

The **colic surface or lower extremity** (*extremitas inferior*) is flat, triangular in shape which rests upon the splenic flexure of the colon and phrenicocolic ligament, which is generally in contact with the tail of pancreas.The **superior extremity** (*extremitas superior*) which is directed toward the vertebral column and it lies in level with the 11 th thoracic vertebra. The **anterior border** (*margo anterior*) is sharp , free and thin, and is often notched, particularly below; it separates the gastric from the diaphragmatic surface. The **posterior border** (*margo posterior*), blunter

and more rounded than the anterior, separates the the diaphragmatic from the renal surface; it corresponds to the lower border of the eleventh rib and lies between the left kidney and diaphragm. The intermediate margin is ridge which separates the gastric and renal surfaces. The **inferior border** (*internal border*) separates the diaphragmatic from the colic surface.

The spleen is almost entirely covered by the peritoneum, which is firmly adherent to its capsule. It is held in position by two folds of this membrane of which one is **lienorenal ligament**, and is derived from the peritoneum, where the wall of the peritoneal cavity comes into contact with the omental bursa between the spleen and the left kidney; the splenic vessels pass between its two layers.

The other fold, **gastrosplenic ligament,** is also formed of two layers, derived from the peritoneal cavity and the omental respectively, where they meet between the stomach and spleen the left gastroepiploic and short gastric branches of the splenic artery run between its two layers. The lower end of the spleen is supported by phrenicocolic ligament.

The weight and size of the spleen are liable to extreme variations at different periods of life , in the same individual under different conditions and in different individuals . *In the adult* it is usually about 7 cm. in breadth, 12 cm. in length, and 3 or 4 cm. in thickness, and weighs

about 200 grams. *At birth* its weight, in proportion to the whole body, is almost equal to what is observed in adult, being 1 to 350; while in the adult it varies from 1 to 320 and 400. *In old age* the organ diminishes not only in weight, but decreases considerably in proportion to the whole body, being as 1 to 700. The size of the spleen is increased during and after digestion, and differs according to the state of nutrition of the body, being small in starved and large in highly fed.

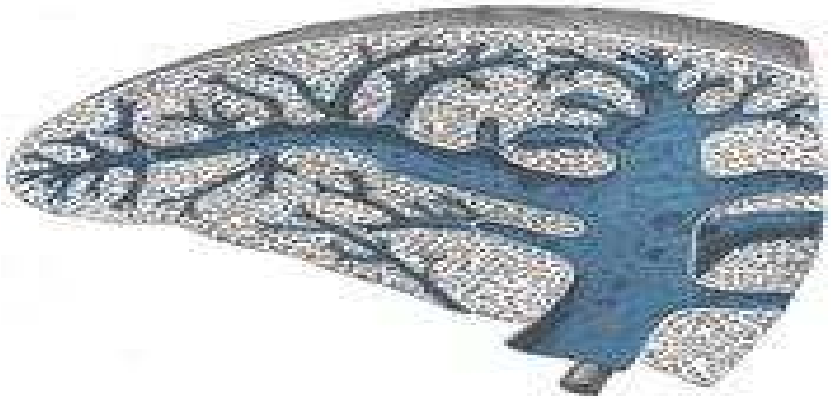
Frequently in the surroundings of the spleen, and especially in the gastrosplenic ligament and the greater omentum, small nodules of splenic tissue may be found, either isolated or connected to the spleen by the thin bands of splenic tissue. They are known as **accessory** (*lien accessorius; supernumerary spleen*) **spleens**. They vary in size from that of a pea to that of a plum.

Structure.—The spleen is invested by two coats: an **internal fibroelastic** and an **external serous coat.**

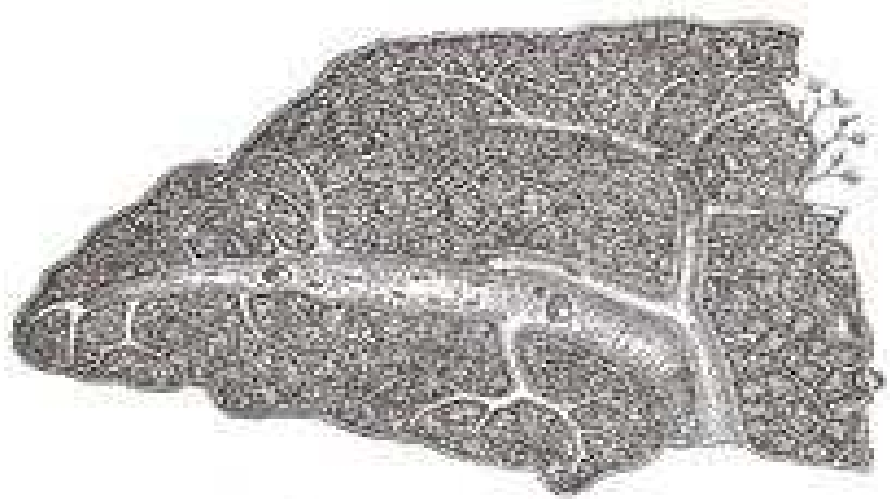
The **external serous coat** (*tunica serosa*) is derived from the peritoneum; it is thin, smooth, and is intimately adherent to the fibroelastic coat. It invests the entire organ, except at hilum and along the lines of reflection of the gastrosplenic and lienorenal ligaments.

The **fibroelastic** (*tunica albuginea*) **coat** invests the organ, and at the hilum is reflected inward over the vessels as sheaths. From these

sheaths, and as well as from the inner surface of the fibroelastic coat, many fibrous bands, **trabeculæ** are given off in all directions; these together constitute the frame-work of spleen. The spleen therefore consists of a number of small spaces (**areolæ**) which contains **splenic pulp,** formed by the trabeculæ.



Transverse section of spleen, trabecular tissue and the splenic vein and its tributaries are shown.



Transverse section of the human spleen, showing the distribution of the splenic artery and its branches.

The **splenic** (*pulpa lienis*) **pulp** is a soft mass of dark red brown color, resembling grumous blood; it consists of fine fibers continuous with that of of trabeculæ. The meshes of the fibres are filled with blood, containing white corpuscles which are found to be in larger proportion than in ordinary blood. Large rounded cells, **splenic cells,** are also present which are capable of ameboid movement, and often contain pigment and RBCs in their interior. In young spleen, giant cells are also found, each containing many nuclei or only one compound nucleus.

Bloodvessels of the Spleen

It is supplied by the splenic artery which is the largest branch of coeliac trunk and also tortuous in course to allow for movements of spleen. It passes through the lienorenal ligament to enter the hilum and it divides into five or more branches. Within the spleen it divided further to form straight vessels called ellipsoids, penicilli and arterial capllaries.

Based on closed theory of splenic circulation , capillaries are continuous with the venous sinusoids which lie in the red pulp. Sinusoids join together to form veins. According to open theory of splenic circulation, the capillaries directly open into red pulp from where blood enters the sinusoids through their walls. The splenic circulation is adapted for the mechanism of separation and storage of red blood cells.

Based upon its blood supply, the spleen is divided into superior and inferior vascular segments. These two segments are separated by an avascular plane. Each segment may sometimes be divided into one to two disc like middle segments and a cap like pole segment.

The altered coat of the arterioles, consisting of adenoid tissue, contain the **lymphatic** (*Malpighian bodies of the spleen*) **nodules** which vary in size from 0.25 mm. to 1 mm. in diameter. They are most frequently found surrounding the arteriole. In transverse sections, the artery, in the majority of cases, is found in an eccentric position. These bodies are visible to the naked eye as minute dots of a semiopaque whitish color in the dark substance of the pulp.

The arterioles end by opening freely into splenic pulp and their walls become attenuated and endothelial cells become changed, presenting a branched appearance, and acquiring processes which are directly connected with processes of the reticular cells of pulp . In this manner the vessels end, and the blood flowing through them finds its way into the interstices of the reticulated tissue of the splenic pulp. Thus the blood passing through the spleen comes into intimate relation with pulp elements which undergoes important changes.

After these changes have taken place the blood is collected from the interstices of the tissue by the rootlets of the veins, which begin in the

same way as the arteries end. The connective-tissue corpuscles of the pulp arrange themselves in rows, in such a way as to form an elongated space or sinus. They become elongated and spindle-shaped, and overlap each other at their extremities, and thus form a sort of endothelial lining of the path or sinus, which is the radicle of a vein.

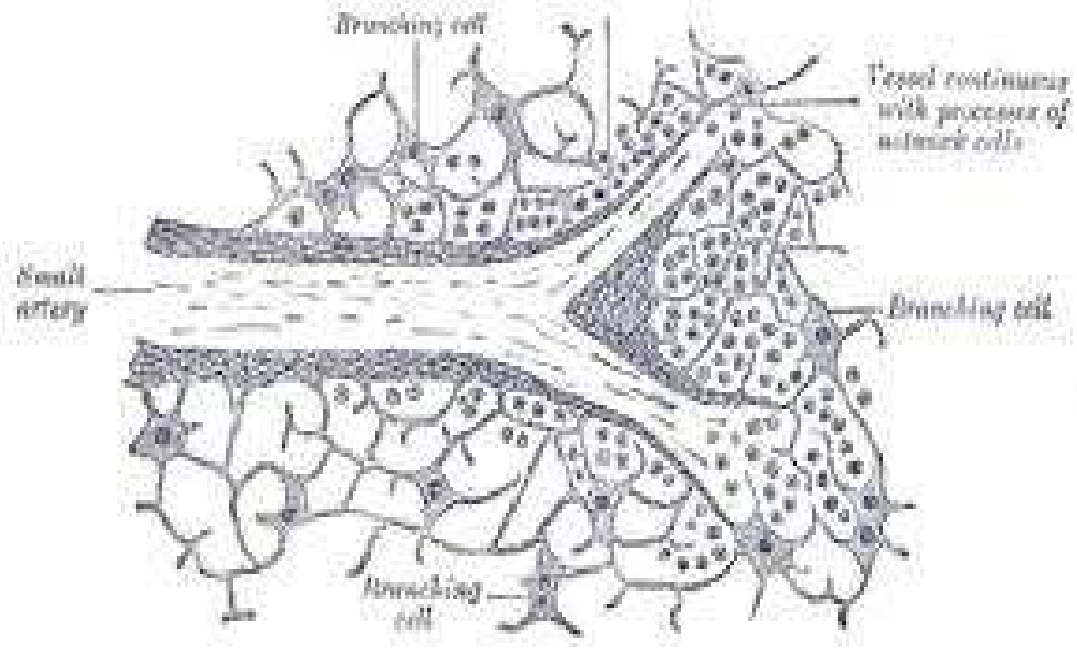
On the outer surfaces of these cells are seen delicate transverse lines or markings, which are due to minute elastic fibrillæ arranged in a circular manner around the sinus. Thus the channel obtains an external investment, and gradually becomes converted into a small vein, which after a short course acquires a coat of ordinary connective tissue, lined by a layer of flattened epithelial cells which are continuous with the supporting cells of the pulp. The smaller veins unite to form larger ones; these do not accompany the arteries, but soon enter the trabecular sheaths of the capsule, and by their junction form six or more branches, which emerge from the hilum, and, uniting, constitute the lienal vein, the largest radicle of the portal vein.

Venous drainage

Splenic vein is formed at the hilum of spleen. It runs behind the pancreas in a straight course .it joins superior mesenteric vein behind the neck of the pancreas to form portal vein. Its tributaries are short gastric, pancreatic, left gastroepiploic and inferior mesenteric veins.

Lymphatic drainage

It has no proper lymphatics , yet a few which arise from the connective tissue of the capsule and trabeculae and drain into the pancreaticosplenic lymph nodes which are situated along the splenic artery.



Section of the spleen, showing the termination of the small bloodvessels

The **nerves** are sympathetic , derived from the celiac plexus and are vasomotor in nature,chiefly non-medullated. They are distributed to the bloodvessels and to the smooth muscle of the capsule and trabeculæ.

GRADING SYSTEM FOR SPLENIC INJURY

To classify the severity of splenic injuries and these have important implications in guiding both operative and nonoperative management decisions.

Organ Injury Scaling Committee (OISC) of the American Association for the Surgery of Trauma[10]

In stratifying the severity of splenic injuries and determining proper therapy but also in providing a standardized and reproducible nomenclature for reporting purposes. This grading system incorporates both CT findings and intraoperative assessment of the injured spleen and consists of five levels of splenic injury, as follows:

Grade[*] and Type of Injury		Injury Description
I		
	Hematoma	<10% surface area , Subcapsular
	Laceration	<1 cm parenchymal depth, Capsular tear
II		
	Hematoma	intraparenchymal, <5 cm diameter Subcapsular, 10-50% surface area;
	Laceration	parenchymal depth of 1-3 cm trabecular vessel not involved
III		
	Hematoma	>50% surface area (Subcapsular) or expanding; ruptured parenchymal or subcapsular hematoma
	Laceration	parenchymal depth of >3cm or trabecular vessels involved
IV		
	Laceration	>25% devascularization of spleen due to laceration involving hilar vessels
V		
	Laceration	Completely spleen shattered
	Vascular	spleen devascularized , Hilar vascular injury

Advance one grade for multiple injuries, up to grade III.

Such severity grading systems notwithstanding, decisions regarding management of individual patients with specific splenic injuries are not cut-and-dried and involve more than simply assigning a severity score and determining therapy. Other factors, such as the mechanism of injury (blunt versus penetrating), the presence of other associated injuries (both intra-abdominal as well as extra-abdominal), the age and overall condition of the patient, and the presence and duration of hypovolemic shock and/or hypothermia all must be taken into consideration and will influence the choice of management in cases of splenic trauma.

Nevertheless, the severity of the splenic injury plays a dominant part in determining whether nonoperative management is appropriate or—if not—whether splenorrhaphy or splenectomy will be the more appropriate surgical option. As a general rule, younger, healthier patients with lower grade splenic injuries and fewer associated injuries and comorbidities are usually managed nonoperatively or with splenic repair, whereas unstable, actively hemorrhaging patients with more severe splenic trauma and/or multiple associated injuries require splenectomy

MANAGEMENT OF SPLENIC INJURY

General Principles

If operative management (either splenectomy or splenorrhaphy) has been deemed appropriate, certain standard principles of trauma care are followed. These include the establishment of reliable large-bore intravenous access, aggressive volume resuscitation, preparation of type and cross-matched packed red blood cells for anticipated intraoperative transfusion, nasogastric decompression, and preoperative intravenous antibiotic administration.

It is our standard practice to utilize a vertical midline incision for all trauma celiotomies because this affords the quickest access to the peritoneal cavity and allows for thorough examination of the entire abdomen to evaluate for the possibility of concomitant injuries. For improved visualization of the left upper quadrant, the midline incision can be extended cephalad, to the left of the xyphoid process, and the left triangular ligament of the liver may be incised to allow reflection of the liver away from the area of interest.

We have found it uniformly helpful to resist the temptation to perform an oblique left upper quadrant incision when an isolated splenic injury is suspected; this approach is invariably more time consuming than

a midline approach, and one is spared the occasional embarrassment of attempting to evaluate or repair an unsuspected concomitant injury elsewhere in the abdomen through an awkward point of access.

On entering the peritoneal cavity, a standard initial trauma survey should be performed in all patients, no matter how high the index of suspicion may be that one is dealing with an isolated splenic injury. All four quadrants should be packed and systematically inspected for hematoma, active bleeding, or biliary or intestinal contents. Preoperative imaging studies may have indicated the presence of isolated splenic trauma, warranting a focusing of attention on the left upper quadrant; however, in the event that multiple intra-abdominal injuries are identified, common sense dictates that the most serious and immediately life-threatening injuries be treated first.

If other injuries take precedence over the splenic injury, in almost all cases the left upper quadrant and splenic bed can be packed with laparotomy tapes so that hemorrhage can be sufficiently controlled until such time that definitive treatment of the splenic injury is undertaken.

In all but the most inconsequential instances of splenic trauma, mobilization of the spleen from its deep and protected location in the left upper quadrant is mandatory to be able to assess fully the location and severity of the splenic injuries. The most helpful initial step in this is the

liberal placement of laparotomy tapes posterior to the spleen, greatly facilitating its elevation into the operative field where it can then be carefully inspected and palpated to characterize the nature of the lesion(s).

Following this preliminary manoeuver, the spleen's ligamentous attachments to the diaphragm, kidney, and colon should be sharply incised. These connections are avascular and can be divided with impunity, except in patients with portal hypertension, in whom enlarged collateral veins may become prominent. Doing so will allow the spleen to be rotated to the midline and further elevated, thus enabling complete access to its anterior and posterior surfaces as well as to the hilum.

Once accomplished, the operator can easily achieve virtually complete hemostasis of any splenic injury: either by direct manual compression of the splenic parenchyma at the site of bleeding or by direct control of the splenic artery and vein at the hilum. At this point, with the spleen fully mobilized, a judgment is then formulated as to whether splenectomy is required or splenorrhaphy should be attempted. In grade I or II splenic injuries, small surface lacerations can often be successfully treated with some combination of manual compression, the topical application of hemostatic agents (e.g., Surgicel, Gelfoam, Avitene, or fibrin glue), or argon beam coagulation **Splenectomy**

Once the spleen has been fully mobilized as described, if splenectomy is to be performed the short gastric vessels are next individually ligated and divided well away from the surface of the greater curvature of the stomach. This reduces the risk of gastric necrosis, which can occur if insufficient care is taken and a portion of the gastric wall is inadvertently incorporated into the ligatures.

It is also at this point—as the short gastrics are divided and the splenic hilum is skeletonized—that particular attention must be directed to avoiding injury to the tail of the pancreas, which is closely applied to the splenic hilum. Inattentiveness here can result in the development of a pancreatic fistula with its attendant morbidity. With the short gastrics completely divided, the splenic artery is then doubly ligated and divided within the splenic hilum, followed by ligation and division of the splenic vein, which completes the splenectomy. Following removal of the spleen, the splenic bed is carefully inspected for hemostasis. If systemic coagulopathy has developed as the result of hemorrhagic shock, consumption of coagulation factors, or hypothermia, the left upper quadrant can be tightly packed with laparotomy tapes while fresh frozen plasma and platelets are administered and efforts are directed at rewarming the patient.

Packs are then carefully removed, individual bleeding sites are electrocauterized and the left upper quadrant is irrigated copiously. These steps are essential to minimize the chances of postoperative splenic bed hematoma, which in turn predisposes to the risk of subphrenic abscess. Although the data are inconclusive regarding the use of drains, we do not routinely drain the splenic bed following splenectomy or splenorrhaphy, preferring instead to emphasize meticulous hemostasis as the best path to avoiding splenic bed complications.

Complications of splenectomy

General

Atelectasis of the left lower lobe , left pleural effusion, seroma in the left upper quadrant and left subphrenic abscess are common, and active physiotherapy should be advised from the first postoperative day. A nasogastric tube is usually not necessary as routine ,as gastric ileus is only for some time.In case of postsplenectomy fever apart from atelectasis or subphrenic haematoma we have to think of OPSI.

Thrombocytosis and thrombosis

By seven to twelve days in the postoperative period , platelet count often increases to between 600 and 1000 × 10^9/. This rise is usually temporary but may extend up to 3 months. If platelet count is 750 ×

10^9/l, in order to prevent deep vein thrombosis , prescribe aspirin (150 mg/day) .

Overwhelming postsplenectomy infection

Definition and cause

Term coined by Diamond in 1969. The clinical state of bacteraemia is caused by commonly the encapsulated organisms *Streptococcus pneumoniae*, and less commonly with *Neisseria meningitidis Haemophilus influenza and Escherichia coli.*

Usually there is absence of a septic focus, and end up in shock, consumptive coagulopathy, adrenal haemorrhage and coma. Because of splenectomy the patient is more susceptible to infection.

1. Impairment of clearance of exogenous organisms by phagocytosis is due to the absence of the red pulp.
2. Due to absence of white pulp, production of antibody and subsequent bacterial opsonization are diminished and poorly opsonized bacteria are destroyed less efficiently by the liver.

Incidence

All studies showing that the incidence is higher in children and adolescents compared to adult. Based on the indication for which splenectomy is performed, its incidence also. If splenectomy is done for

traumatic injury , only 2 to 3 per cent of children develop overwhelming postsplenectomy infection. The risk is more in patients undergoing splenectomy for portal hypertension , congenital anaemias, or lymphoreticular tumours.

The onset of development also varies in relation to the splenectomy. It usually occurs within 3 years after the operation but it can occur up to 30 years after loss of the spleen. It is very important , as this infection is associated with a very high mortality rate (25–75 per cent reported in many series).To avoid this complication, splenic preservation procedures came. Attempts to preserve the spleen can be achieved by conservative, non-operative management, or by one or other of the splenic salvage operations described in the previous section.

Splenorrhaphy

The term *splenorrhaphy* actually represents a variety of “spleen-sparing” techniques aimed at controlling the hemorrhage from a splenic injury while sparing the patient from the long-term immunologic consequences of splenectomy. The intraoperative decision to attempt splenorrhaphy should be made only after the spleen has been fully mobilized in the process of assessing the injuries.

As a general rule, splenorrhaphy is most appropriately considered in cases of less severe splenic injury (e.g., grades I and II, and occasionally grade III). Splenorrhaphy should not be attempted to repair extensive or complex shatter or crush-type injuries of the spleen, nor is it well-advised to undertake splenorrhaphy in the face of multiple concomitant traumatic injuries or associated hypotension. With the spleen fully mobilized and controlled with the surgeon's hand, splenorrhaphy may consist of nothing more than manual compression of the splenic parenchyma between thumb and finger to achieve hemostasis of simple lacerations.

If this is insufficient to control bleeding , a variety of topical hemostatic agents may be applied directly to the bleeding surface, as already mentioned. The placement of a simple monofilament suture through the splenic parenchyma (often in a mattress technique and incorporating a piece of Gelfoam or an omental patch placed at the site of bleeding) will often bring about satisfactory hemostasis. Alternatively, wrapping the entire spleen with either absorbable or nonabsorbable mesh has been described as a means of effecting external tamponade and controlling bleeding and has not been associated with significantly increased risk of infectious complications.

Laparoscopic Splenectomy

With the introduction and refinement of new technologies such as the endoscopic staplers and harmonic scalpel ,laparoscopic performance of all of the aforementioned methods of splenic salvage (e.g., splenorrhaphy , partial splenectomy , hemostatic agent application) has been described in the trauma setting. As with all types of laparoscopic surgery, there is a considerable learning curve with laparoscopic splenectomy, and in other than experienced hands, the increased time taken can have deleterious consequences in actively hemorrhaging or hemodynamically unstable patients. This, combined with the increasing role of nonoperative management and angiographic embolization techniques, makes it unlikely that laparoscopic splenic surgery will become the standard of care in the trauma setting.

Autotransplantation

Autotransplantation of splenic tissue has been described as a means of preserving some remnant of the spleen's reticuloendothelial function in cases of severe splenic trauma when splenorrhaphy is not possible and formal splenectomy would be the only surgical option.

The efficacy of autotransplantation in maintaining immunologic competence has never been validated, and multiple cases of OPSS have

been reported after autotransplanation.[20] Consequently, this technique remains controversial and is not to be endorsed for routine use.

NONOPERATIVE MANAGEMENT

Over the past several years an increasing number of patients with blunt splenic trauma have been successfully managed nonoperatively. The success of nonoperative management strategies has largely correlated with the increased availability of high-resolution CT scanning and advances in selective arterial catheterization and embolization techniques.

In properly selected , hemodynamically stable patients with blunt splenic trauma, nonoperative management consists of bed rest, serial abdominal examinations, and hemoglobin and hematocrit determinations—all best carried out in a monitored setting. Clinical indices associated with failure of nonoperative management include higher grade of splenic injury, increased transfusion requirement, and hypotension at presentation.

Patient age (>55 years) has been shown by some to accomodate poorly for nonoperative management[27,28]; however, the experience of others has failed to validate this.[29–32] The presence of associated intra-abdominal injuries or altered level of consciousness are significant obstacles to successful nonoperative management and should be

considered relative contraindications. As vascular interventional techniques have evolved and become more prevalent in recent years, the selective use of splenic embolization as an adjunct to nonoperative management has resulted in improved success rates, with reduced need for delayed operative intervention.

With these techniques now more readily available and more widely used, even patients with CT findings of active extravasation—previously considered an absolute indication for immediate operative intervention—can often be managed nonoperatively if embolization can be successfully performed.[40,41] Unfortunately, CT or angiographic demonstration of traumatic splenic arteriovenous fistulization continues to be predictive of a high failure rate (40%) of nonoperative management.[35]

Most patients who fail nonoperative management require intervention (splenectomy , splenorrhaphy or embolization) within 48 to 72 hours, whereas a minority (5% to 6%) develop complications more than 4 days following injury.[31,42] Such complications include delayed hemorrhage requiring operation or embolization, splenic artery pseudoaneurysm formation, and the development of splenic pseudocyst or abscess.

Delayed Splenic Rupture

Delayed splenic rupture, the sudden unheralded rupture more than 48 hours after initial trauma of a demonstrably normal spleen in a hitherto asymptomatic, hemodynamically stable patient, is an infrequent but potentially catastrophic complication of splenic injury.

This phenomenon, separate and distinct from late splenic rupture after failed nonoperative management of documented splenic injury or unsuccessful splenorrhaphy, probably represents the late, sudden expansion of an occult subcapsular hematoma not detectable on the initial CT scan.[43] Minor, self-limited subcapsular bleeding that attains initial hemostasis and goes undetected on initial radiographic evaluation is thought to increase suddenly when endogenous thrombolysis is reactivated several days after injury.

Increased subcapsular tension may be further aggravated by oncotic forces in the subcapsular space, leading to rupture and massive hemorrhage. Because of difficulties distinguishing this entity from either the missed or delayed diagnosis of a discernable splenic injury, the true incidence of delayed splenic rupture is not known.[44]

ASPLENIA PROPHYLAXIS

Patient with post-traumatic asplenia need antibiotic prophylaxis. Prevention of life-threatening infection in post-splenectomy patients involves vaccination, antibiotics, and education.

Vaccination

Vaccination against *S. pneumoniae* is highly recommended in all post-splenectomy patients. Two versions of vaccine exist—the polysaccharide vaccine, which includes 23 serotypes (PPV23), and the tetanus-conjugate heptavalent vaccine (PCV7). The heptavalent vaccine should be given to all children between the ages of 2 and 23 months, with asplenic and other high-risk groups receiving two additional doses after the age of 2 years.

Additionally , the polysaccharide vaccine should be given 2 to 3 months after the final dose of PCV7, with consideration of boosters every 6 years. Some authors have advocated determination of antipneumococcal titers to document vaccine response and to identify poor responders, but this practice has not gained widespread acceptance.[10]

Vaccination against *H. influenzae* is thought to be safe and is recommended for all post-splenectomy patients. A course of three

separate vaccines is given to infants, but a single dose should be effective for children older than 1 year.There are few data regarding the response of splenectomized patients to the meningococcal vaccine. However, it has been shown to have an effective safety and immunogenic profile in adults, and many centers, including our own, routinely offer the meningococcal vaccine to asplenic patients.

Antibiotics

For children less than 3 years oral Penicillin V 125 mg twice daily to be given and 250 mg twice daily for those 3 to 14 years old,500 mg for adult is the recommended dosage. The age at which prophylaxis is discontinued is controversial.

Education

It is probably the most important in preventing serious infection. The surgeon needs to emphasize to patients that any fever constitutes a potential life-threatening emergency and medical care should be sought as soon as possible. Early and aggressive parenteral therapy targeted against encapsulated organisms should be standard when concerns of infection exist in this group of patients.

MATERIALS AND METHODS

This study was a prospective study of 20 cases of splenic injury abdomen admitted in the triage ward of Mahatma Gandhi Memorial Government Medical College Hospital -Trichy , from October 2010 to October 2012 . Once the patient is admitted the name, age, sex and mode of injury are noted. The time interval between splenic injury and admission and time interval between admission to hospital and surgery are recorded. After resuscitating the patient, all patients were subjected to careful clinical examination.

Depending on the clinical findings, decision was taken for further investigations such as four-quadrant aspiration, X-ray abdomen, ultrasound and CT abdomen . The decision for operative & non-operative management depended upon the outcome of clinical examination & diagnostic tests. Patients selected for conservative management were placed on strict bed rest, serial clinical examination which included hourly pulse rate, blood pressure, respiratory rate and repeated abdominal examination. In those who are operated, the operative findings and methods of management are recorded. Cases are followed up till their

discharge from the hospital. If patient expired postmortem findings are noted. Post operative morbidity and duration of hospital stay were recorded. The above facts are recorded in a proforma prepared for this study.

OBSERVATIONS AND RESULTS

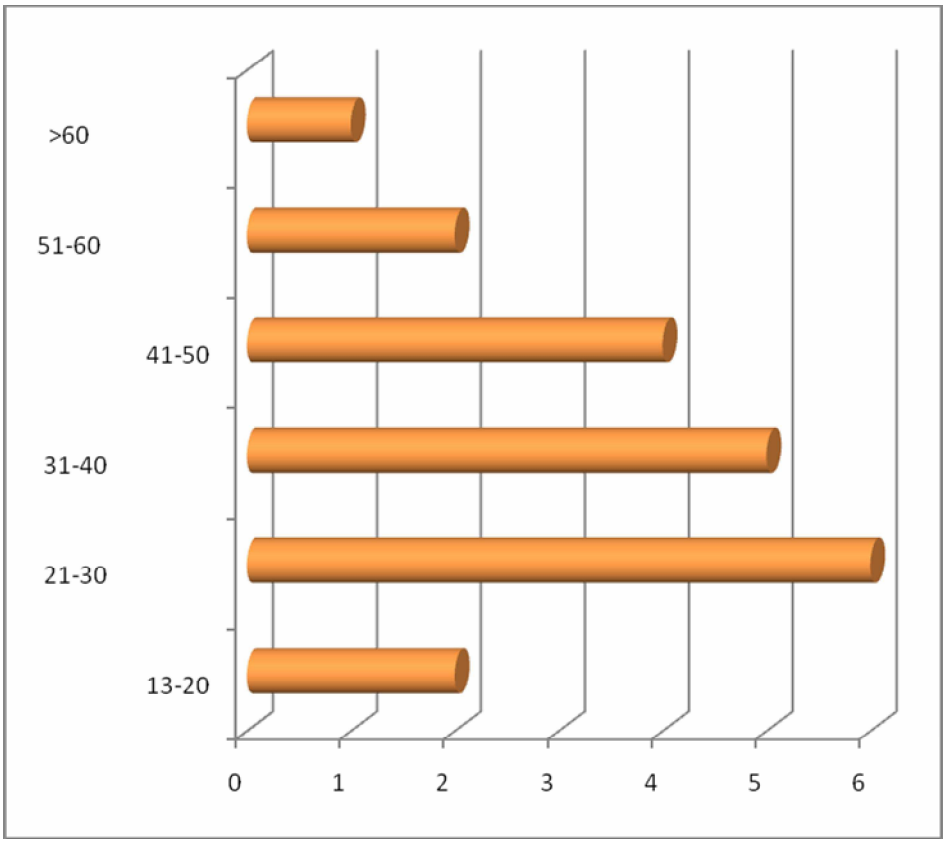
The total number of patients who had sustained splenic injuries were 20. In this study of the 20 patients 15 cases were male and 5 cases were females. The increase in the incidence of association of males is due to acts of violence and vehicular accidents.

Age Distribution

Table 1: Age Group Affected

Age group (years)	Number	%
13-20	2	10%
21-30	6	30 %
31-40	5	25%
41-50	4	20%
51-60	2	10%
>60	1	5%
Total	20	

Table 1 shows the age group involved in this study.



.

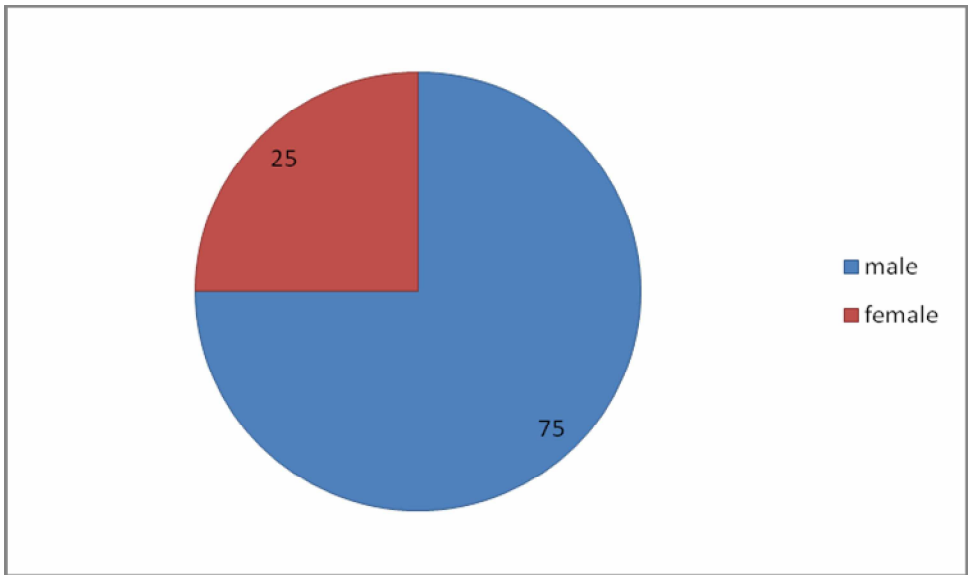
In this, paediatric age group was omitted. The majority of patients belonged to 21-30 years i.e. 6 out of 20 cases , constituting about 30%, followed by 31-40 years age group ,contributing 25% . Two cases were in second decade, four cases in fifth decade , two cases in sixth decade and only one patient was above the age of 60 years

Sex Incidence

Table 2: Sex Incidence

Gender	No of patients	%
Male	15	75 %
Female	5	25 %
Total	20	100 %

Total : 20

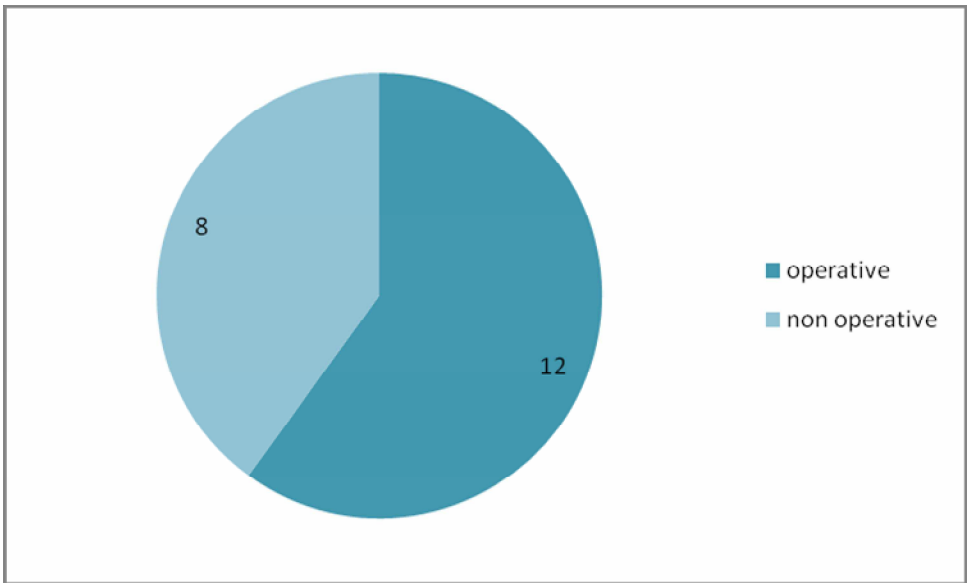


As given in the Table 2 out of 20 cases studied, 15cases were males, with females accounting for about only 5 cases .

Ratio of Operative to Non-operative Management

Table 3: Operative vs Non-operative

Type	No of Patients	%
Operated	12	60%
Conservative	8	40%



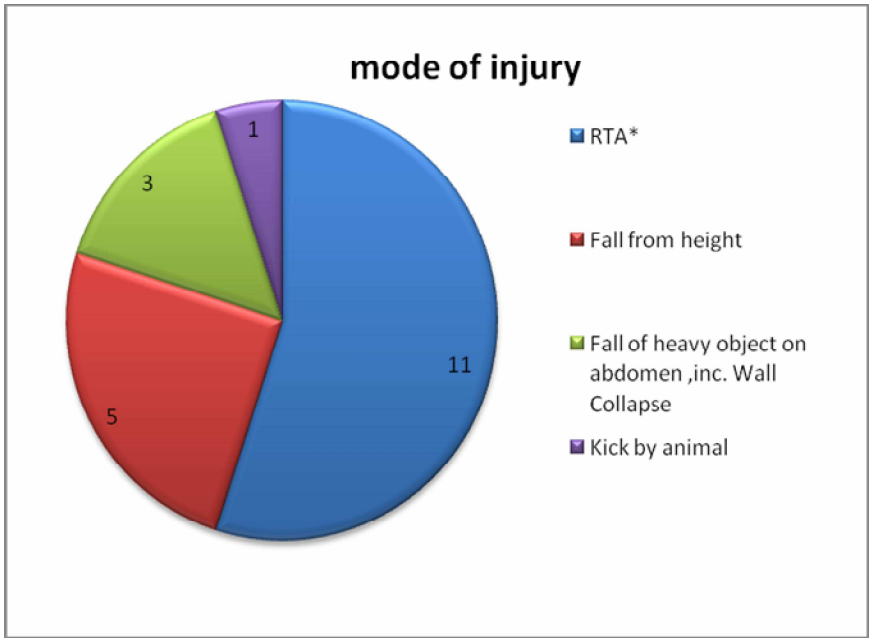
After a detailed clinical evaluation and suitable investigations, 12 patients with hemoperitoneum with hemodynamic instability underwent exploratory laparotomy. About 8 patients were selected for non- operative management because they had no signs of peritonitis or they had minimal hemoperitoneum but hemodynamically stable .

Mode of Injury

Table 4: Mode of Injury

Mode of Injury	NO. of Cases	%
RTA*	11	55%
Fall from height	5	25 %
Fall of heavy object on abdomen ,inc. Wall Collapse	3	15 %
Kick by animal	1	5 %

*RTA–RoadTrafficAccidents



Out of 20 cases ,11 cases were due to road traffic accidents due to motor vehicle collision on pedestrian injury . So , Road traffic accidents are the major cause of splenic trauma to patients, constitutes about 55 % of total splenic injury abdomen.The next common cause is fall from height constituting about 25%, followed by fall of heavy weight on abdomen of 15%. A rare case of splenic injury due to kick by a bull was also reported.

Symptoms & Signs

The following table shows the incidence of various symptoms & signs with which the 20 patients studied presented with

Table 5 : Symptoms and Signs

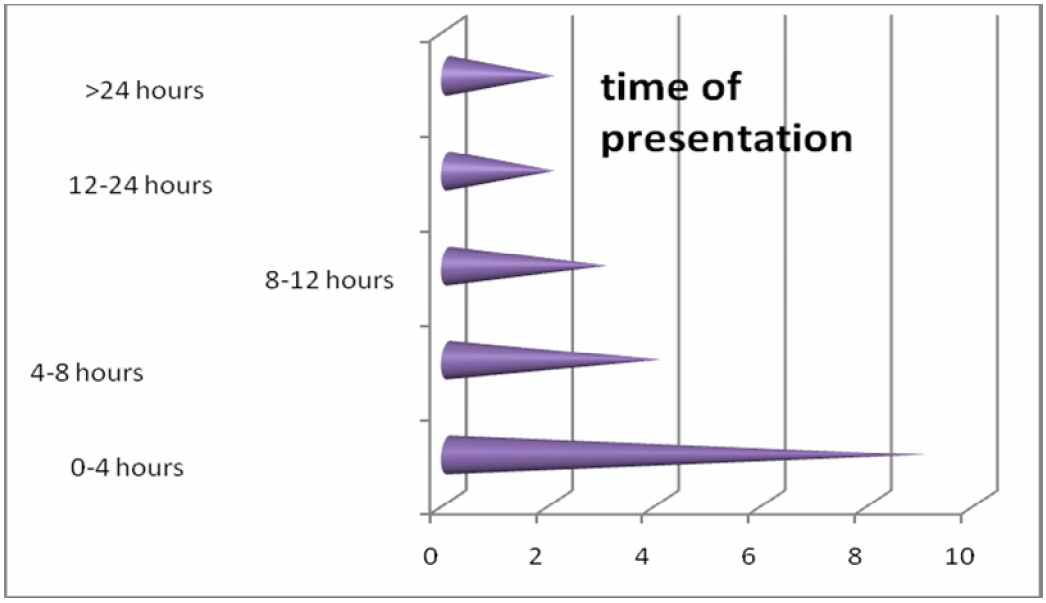
Symptoms & Signs	No.of Patients
Abdominal Pain	15
Abdominal Distension	12
Guarding & Rigidity	12
Abdominal Tenderness	14
Pallor	10
Pulse >100//min	12
BP <90 mmHg systolic	11
Absent Bowel Sounds	8

Majority of patients presented with abdominal pain & abdominal tenderness. **Latent Period**

The analysis of the time interval between injury to the time of presentation

Table 6: Time of Presentation

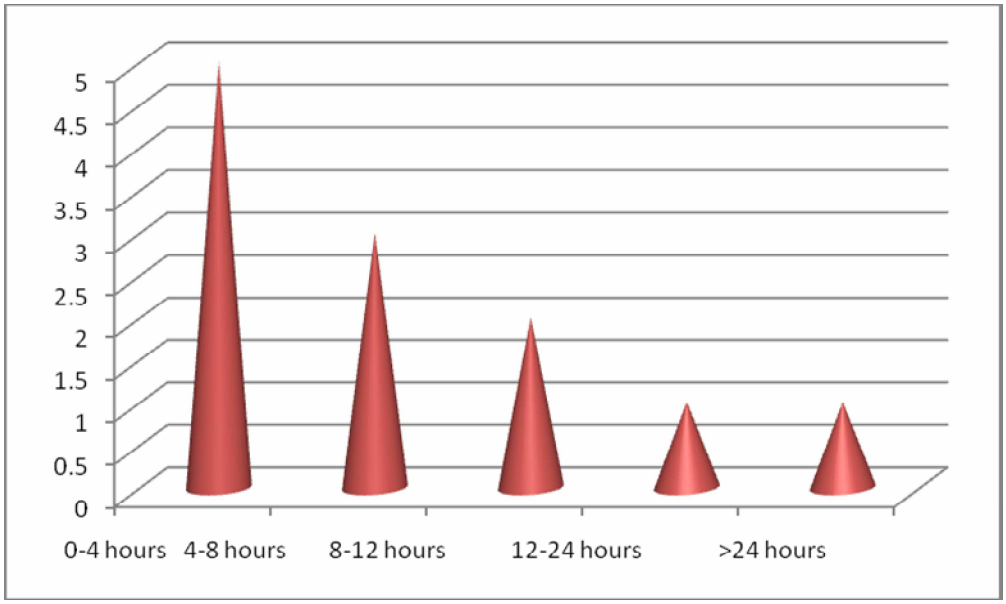
Time Interval	No. Of Cases	**%**
0-4 hours	9	45%
4-8 hours	4	20%
8-12 hours	3	15 %
12-24 hours	2	10 %
>24 hours	2	10 %



Majority of cases presented within 4 hours of injury, constituting about 45%. The analysis of the time interval between presentation to the time of surgery.

Table 7: Latent Period

Time Interval	No. Of Cases	**%**
0-4 hours	5	41.6%
4-8 hours	3	25%
8-12 hours	2	16.6 %
12-24 hours	1	8.3%
>24 hours	1	8.3%

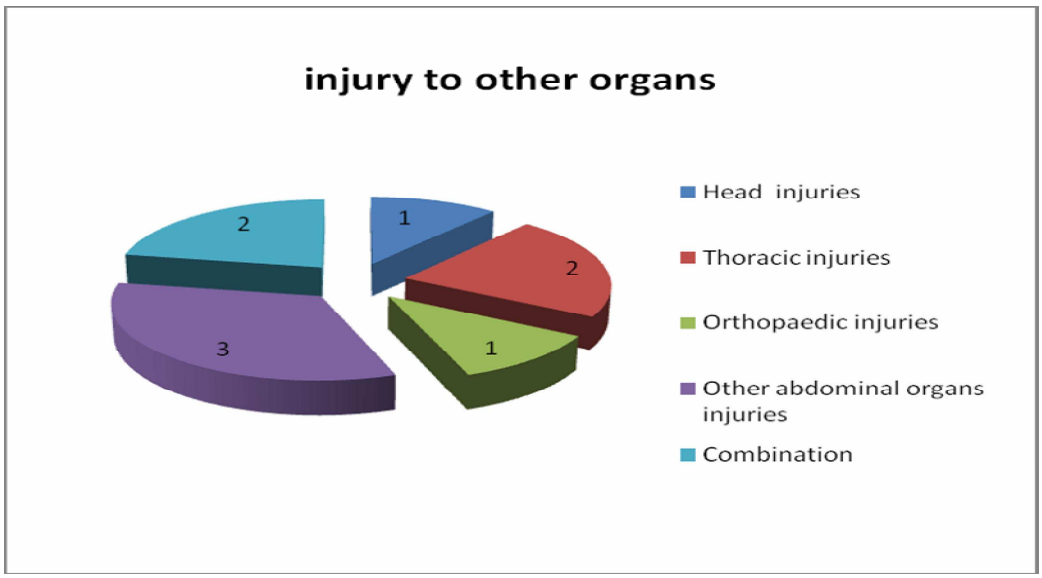


The average latent period is 4-8hours while majority of patients were taken up for surgery within 4 hours of presentation

Associated Injuries

Table 8: Injury to other organs

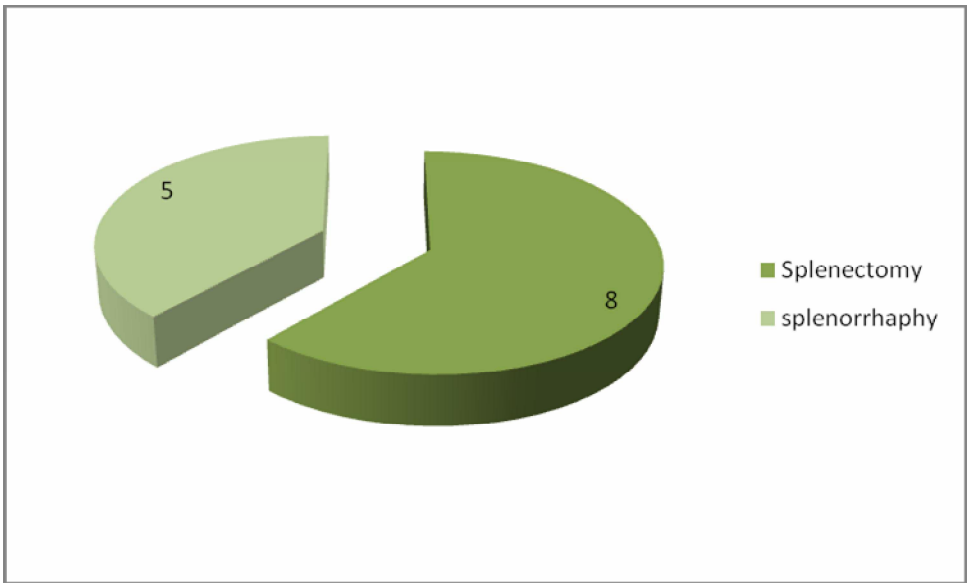
Other injuries	No of patients	**%**
Head injuries	1	5 %
Thoracic injuries	2	10 %
Orthopaedic injuries	1	5 %
Other abdominal organs injuries	3	15%
Combination	2	10.5 %



Associated other organ injuries were found in 9 cases. The common is other intra abdominal organ injuries.

Operative: splenectomy vs splenorrhaphy

Operative	Total no cases
Splenectomy	8
splenorrhaphy	5



Based upon the grading of injuries to spleen,hemodynamic stability,other associated organ injuries, the decision of splenectomy versus splenorrhaphy was taken.

INVESTIGATIONS

Plain X-ray Abdomen

Plain X-ray abdomen was done in all 20 cases. Gas under the diaphragm was found in only about 2 cases . 2 bowel perforations were detected at laparotomy. The following table shows the abnormal findings detected in X-ray erect abdomen.

Table 9: X-ray Abdomen Findings

Feature	No. of Patients
Gas Under the Diaphragm	2
Ground glass appearance	2
Dilated loops	3

Four Quadrant Aspiration

The number of patients who underwent four quadrant aspiration were 15.

Table 10: Four Quadarant Aspiration Results

Result	No of patients	Percentage
Positive	**6**	40 %
Negative	**9**	60 %
Total	15	

The following table analysis the results of four quadrant aspiration and splenic injury at laparotomy

Table 11: Four Quadrant Aspiration vs Laparotomy Findings

Four Quadrant Aspiration	Organ Injury At Laparotomy		**Total**
	Present	Absent	
Positive	4	2	6
Negative	5	4	9
Total	9	6	15

Four Quadrant Aspiration had a sensitivity of 44.4 % and a specificity of 66.6 %.

Ultrasound Examination

A total of 20 patients were subjected for ultrasound examination.free fluid was seen in 8cases. splenicParenchymal injury without free fluid 5cases.

CT Scan Abdomen

A total of 10 patients underwent CT scan abdomen in the study. CT scan abdomen was very helpful in grading the injury and managing the haemodynamiccally stable patients conservatively.

Post Operative Complication

The following table shows the post operative complications in patients who underwent exploratory laparotomy

Table 14: Post operative complications

Complication	Number of patients
Wound dehiscence&infection	3
OPSI	1
Respiratory complication	4

Morbidity & Mortality

The mean range of stay of patients in the hospital ranged from 10-19 days. The range varied from 5 days to 46 days. The following table shows duration of hospital stay of patients with blunt abdominal trauma including those who died.

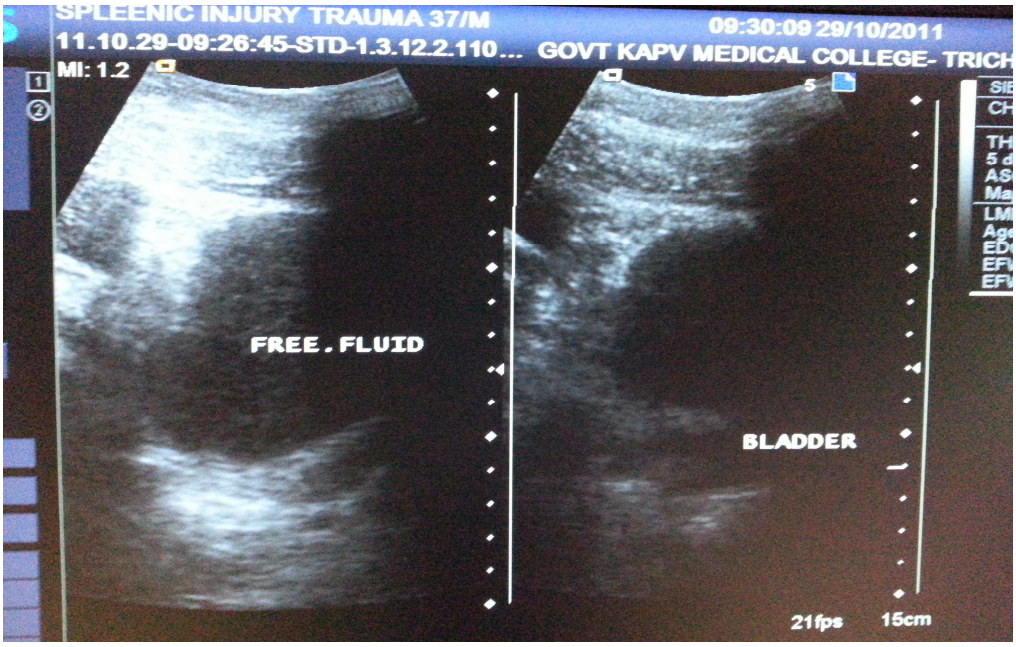
Table 15: Duration of Hospital stay

Duration (days)	No. of Patients	Percentage
1-9	4	20 %
10-19	10	50 %
20-29	4	20 %
30-39	2	10 %

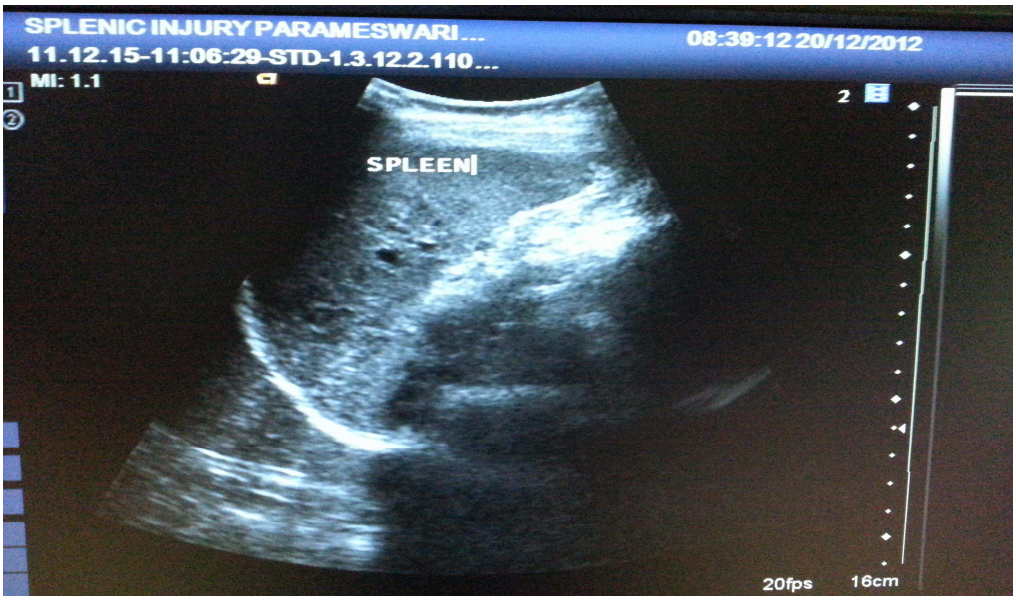
Mortality :

3 patients with splenic injury abdomen died in the present study. 2 patients belonged to operative group & died in the post operative period due to infection and remaining one due to associated head injury. Therefore the mortality rate in the present study is 15%.

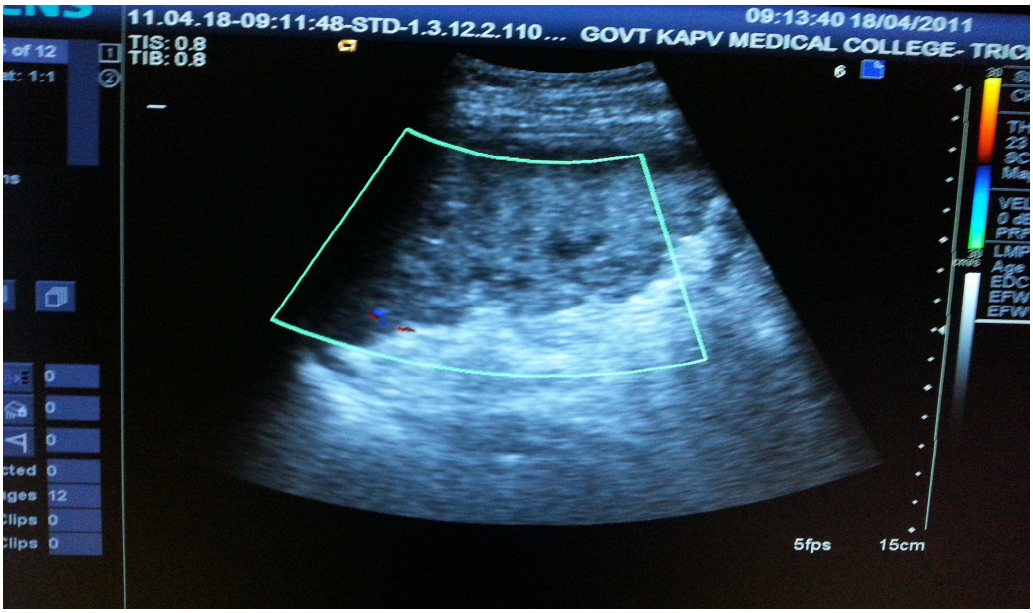
USG showing free fluid in splenic injury



USG showing splenic injury

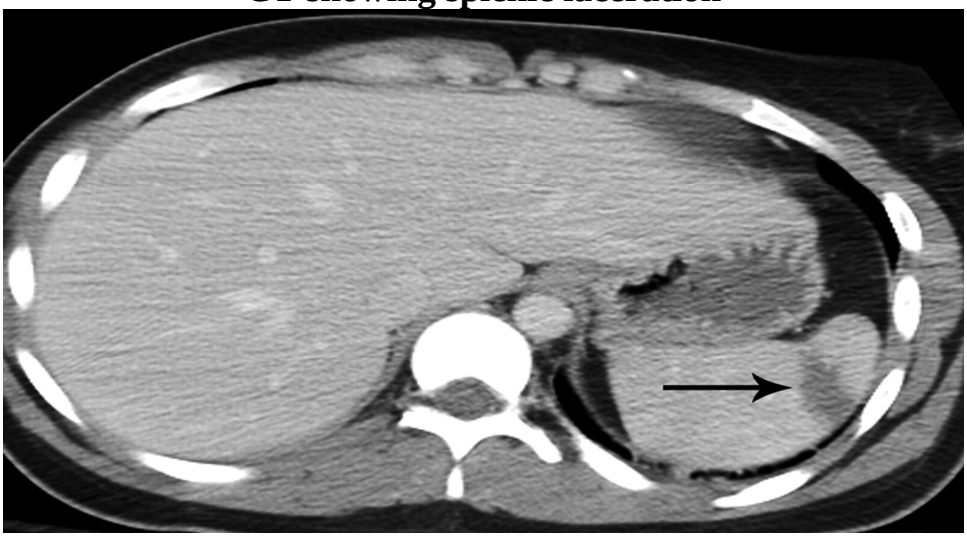


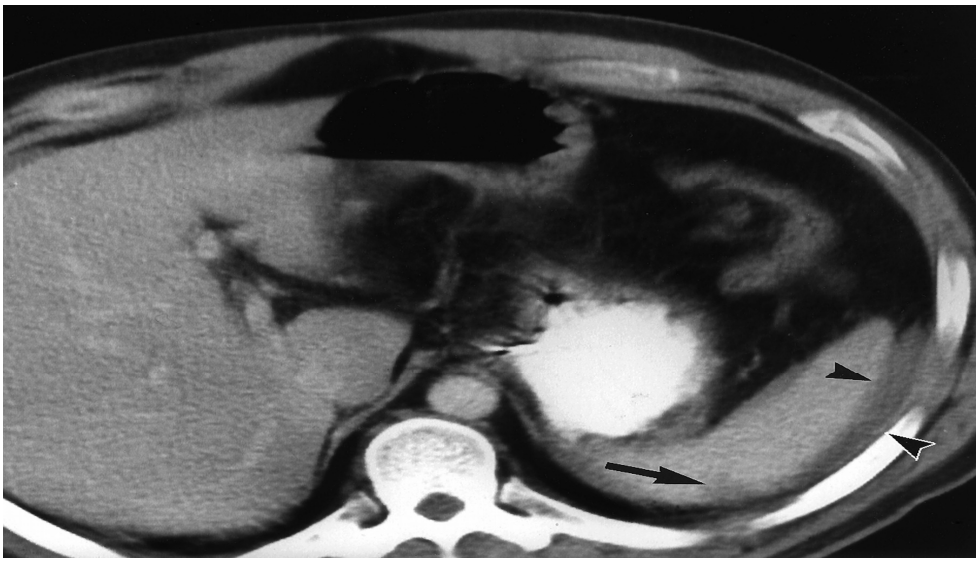
USG showing grade 5 (hilar) splenic injury



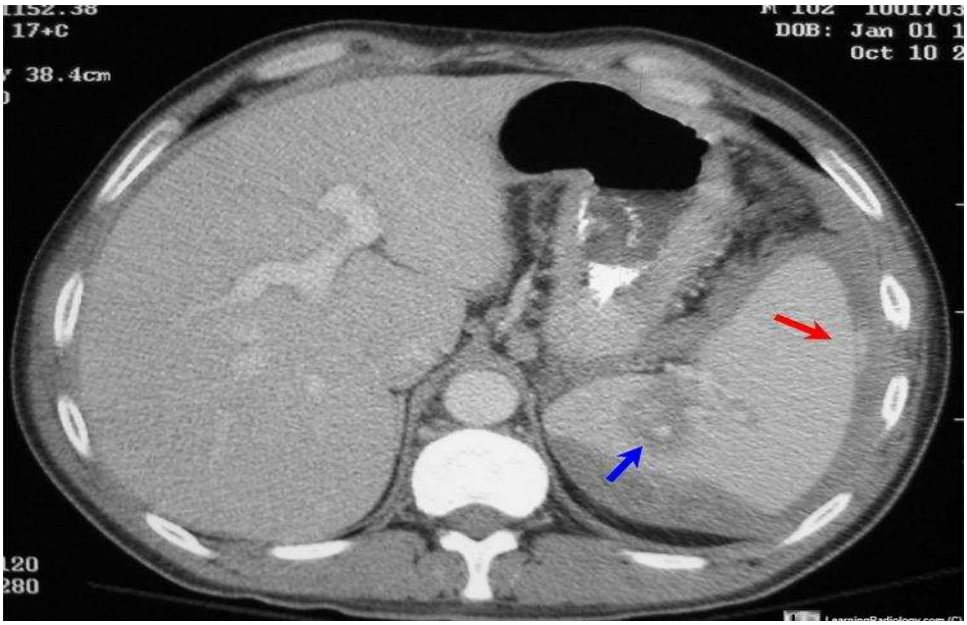
USG showing splenic laceration

CT showing splenic laceration





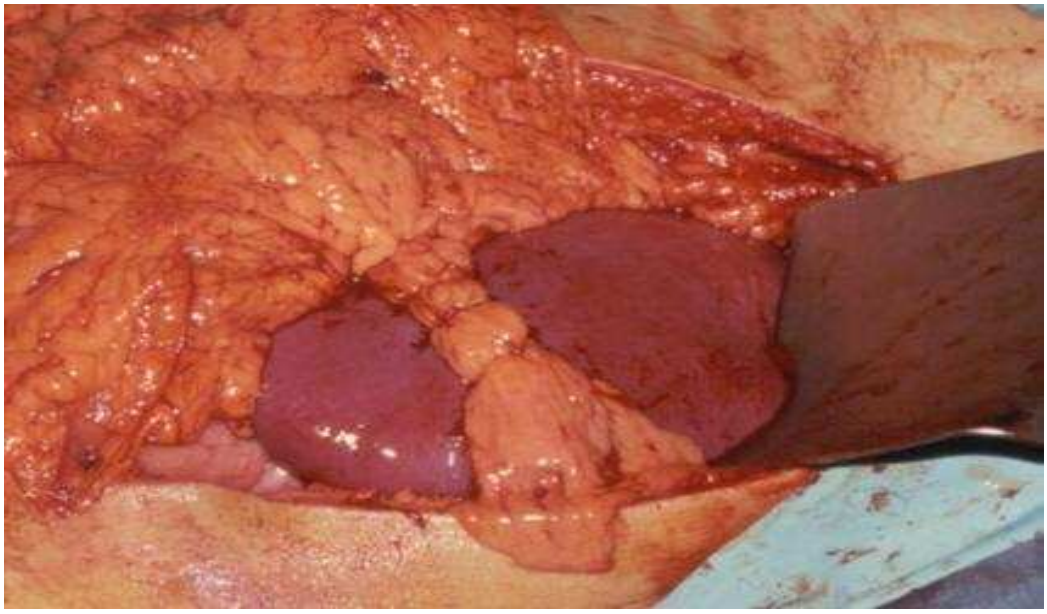
CT showing subcapsular hematoma & laceration



Ruptured subcapsular hematoma in spleen

grade 2 splenic injury

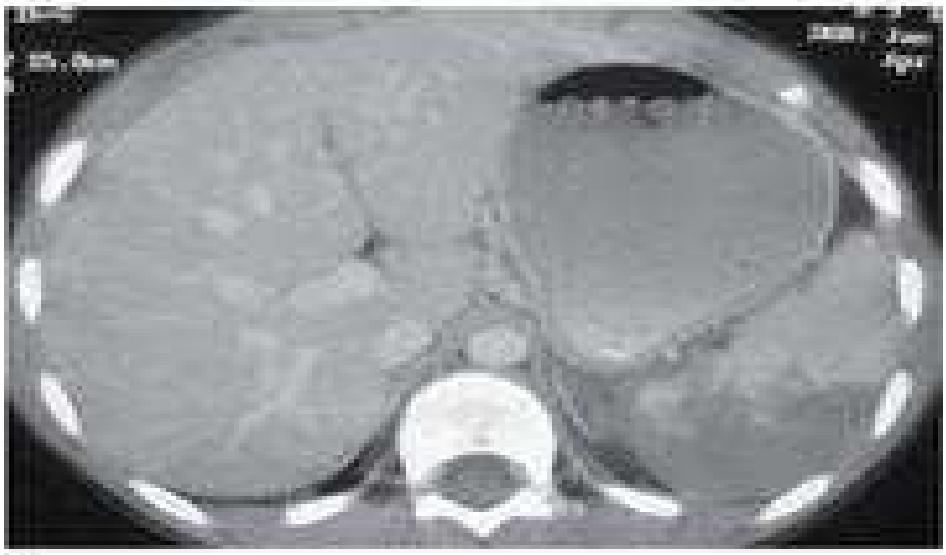
Repair with omental pedicle



CT showing grade 3 splenic injury

grade 3 splenic injury - mesh splenorhaphy

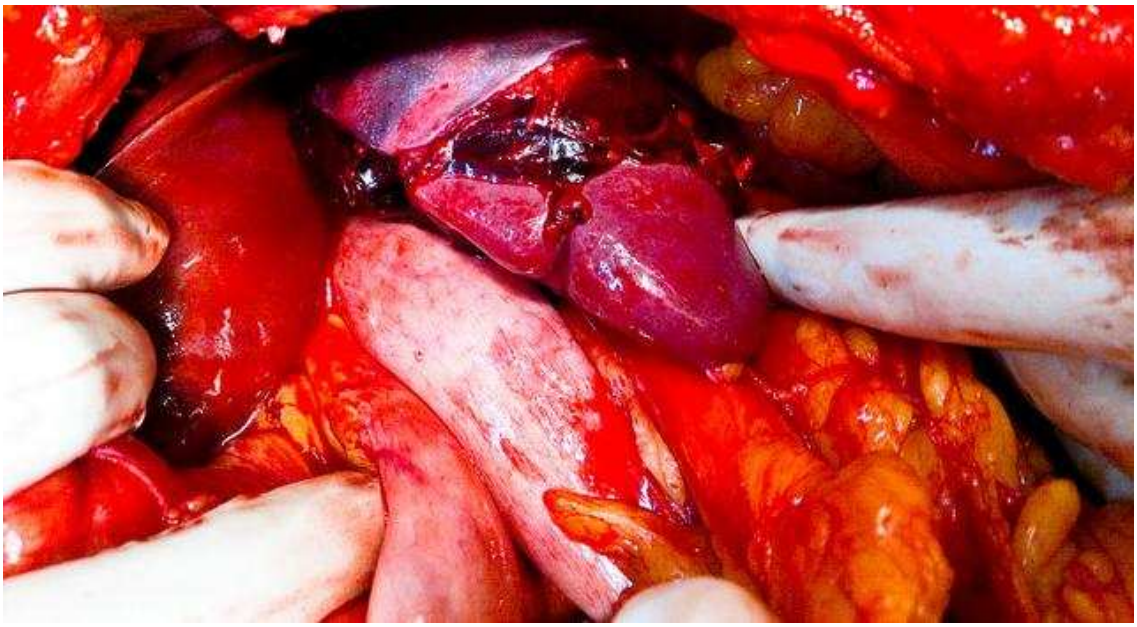
CT showing grade 4 splenic injury



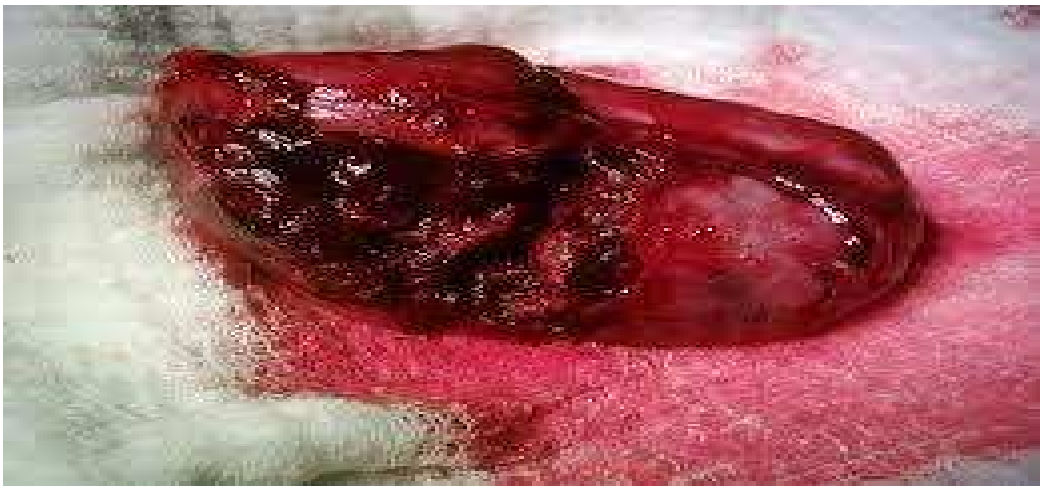
A

CT showing grade 5 splenic injury

Per operative grade 5 splenic injury



Splenectomy for hilar injury



Splenectomy for subcapsular hematoma

DISCUSSION

Road traffic accident forms the single most important cause for splenic injury abdomen in our study .This assumes all the more significance because people involved in RTA are in their most active and productive phase of life.Injury is the commonest cause of death among people aged 1 – 34 years in the westernworld.

By the year 2020 road traffic accidents will be the second most important cause ofdeath in developing nations. Prevention is better than cure. A 10% increase in speed translates into 40% rise in casefatality risk for the occupants of motor vehicle. Use of seat belts reduces the risk of death or

serious injury for front seat occupants by 45%. Helmets reduce the risk of fatal head injury byabout one-third and reduce the risk of facial injury by two thirds.among persons who ride twowheelers. Avoiding alcohol before driving is an important preventive step.

In the management of poly trauma patients,the steps in the ATLS philosophy should be followed.

(a) Primary survey with simultaneous resuscitation of the patient.

(b) Secondary survey to proceed and identify all other injuries.

(c) Tertiary survey and definitive care of the injuries.

The steps in the primary survey are

1. Airway with stabilisation of cervical spine.

2. Breathing and oxygen supplementation.

3. Circulation and hemorrhage control.

4. Disability evaluation.

5. Exposure and complete examination

In this study of 20 patients, who were admitted in triage ward, met with deceleration type motor vehicle accident, a driver with a driver's side impact type motor vehicle accident or any patient with a direct blow to the left lower ribs or left upper quadrant of the abdomen.Based upon the clinical conditions and supportive investigations like plain x-ray abdomen,four quadrant aspiration, ultrasound abdomen ,CTscan, hemodynamically unstable patients resuscitated.

After improving the general condition of the patient, laparatomy proceeded in 12 cases, in which splenectomy done in 8 cases as there was massive hemoperitoneum in 6 cases , rest 2 cases (general condition didn't improve inspite of resuscitation). The following indication for laparotomy were included in our study.

1. Progressive shock not improved with resuscitative measures.
2. shattered or avulsed spleen
3. Multiple associated intraabdominal injuries

4. Haemoperitoneum
5. Rupture of an obviously diseased spleen

Open splenectomy done in all above mentioned cases and drainage tube kept in left flank,which was usually removed by third or fourth day.

In the remaining 4 cases splenorrhaphy was done, ie in *stable patients *CT evidence of grading of splenic injury * few associated intra abdominal injuries

Where two cases were managed by topical hemostatic agents such as surgical (oxidized regenerated cellulose) where there was no associated injuries . Rest of two cases were managed by sutural repair with 3/0 chromic catgut . chromic suture is easy to handle , slides through the spleen without friction and has needles large enough to make even deep stitches .

It should be noted , however ,that a variety of other absorbable or permanent suture materials have been successfully used during splenorrhaphy.The correct amount of tension to apply when tying chromic sutures across a splenic laceration is similar to that used when hepatic sutures are tied; i.e., no further tension should be applied once the chromic suture starts cutting through the rather friable capsule of the adult spleen.

To avoid tearing through splenic tissue, *viable pedicle of omentum can be readily mobilized from the adjacent stomach or colon. *use of Teflon pledgets ,but that was not done in this study of patients.

Among 12 patients who underwent surgery either splenectomy or splenorrhaphy , four patients developed respiratory complications in the form of left lower lobe pleural effusion and atelectasis(minimal).They were managed conservatively with chest physiotherapy and antibiotics.

Three patients developed wound infection, serous and seropurulent discharge came, wound swab was sent for culture and sensitivity and based upon the reports antibiotics were given and twice daily dressing done and gradually it settled down.

Two patients died of infection [?overwhelming post splenectomy infection] in the post operative period in whom there were no septic focus, patient developed fever with chills , blood culture was inconclusive and were treated with higher antibiotics. Inspite of that patient suddenly collapsed by developing hypotension and we lost that patient by 10^{th} postoperative day. Mostly patients were discharged by 10 to 15 days.

Only in patients who have associated injuries discharge was delayed. 8 cases managed conservatively , as the grading of injury was less severe, and followed up with repeat ultrasound done to assess the

resolving status.Conservative management included bed rest,iv antibiotics, analgesics,and vitals monitoring.

Usually patients were discharged after repeat ultrasound and advised to avoid heavy work atleast for 1 month.

CONCLUSION

- Road traffic accident is the commonest cause for splenic injury abdomen
- Predominance of male over female in splenic injury abdomen with the ratio of 3:1.
- People in the age group of 3rd & 4th decade were commonly involved in splenic injury abdomen constituting about 55 %.
- Based upon the grading of injuries and hemodynamic stability of the patient and other associated injuries , decision of laparatomy versus conservative management decision was taken
- 12 patients were managed surgically,8 underwent splenectomy and 4 underwent splenorrhaphy by topical hemostatic agents and sutural repair .
- Overall mortality due to splenic injury abdomen was 15%.
- Sepsis and associated injury were the major causes of death.

PROFORMA

NAME : I.P. NO. :

AGE / SEX : UNIT :

INCOME: ADDRESS:

TIME OF ADMISSION: TIME OF INJURY:

DATE OF DISCHARGE: DATE OF SURGERY :

MODE OF INJURY:

LIST OF INJURIES:

C/O

1.PAIN – Present or absent
Site of pain
Nature of pain
Duration

2.ABDOMINAL DISTENSION – Present or absent
Duration

3.VOMITING – Present or absent

4.H/O passed / not passed – motion / flatus / urine

5.H/O hematuria / hematochezia / malena

6.INTOXICATED : YES / NO

PAST HISTORY:

PERSONAL HISTORY:

GENERAL EXAMINATION:

VITALS:

Pulse:

BP:

Respiration:

Temperature:

ABDOMINAL GIRTH: On admission

OTHER SYSTEMS EXAMINATION

- CVS
- RS
- CNS
- MUSCULO-SKELETAL SYSTEM

ABDOMINAL EXAMINATION

1.Inspection

-Description of injury

- abdominal distension

2.Palpation

-Tenderness

- guarding and rigidity

3. Percussion

- free fluid

- Splenic dullness

- liver dullness

-renal angle dullness

4.Auscultation

-bowel sounds

-bruit

EXAMINATION OF EXTERNAL GENITALIA:

PER RECTAL EXAMINATION:

PER VAGINAL EXAMINATION:

ASSOCIATED INJURIES:

INVESTIGATIONS:

Blood – Hb%

TC

DC

SUGAR

UREA

Sr .CREATININE

Sr. ELECTROLYTES

AMYLASE

BLOOD GROUPING & TYPING

URINE - ALBUMIN, SUGAR , DEPOSITS

DIAGNOSTIC PARA CENTESIS: positive / blood / bowel effluents

PLAIN X-RAY ABDOMEN : findings –

USG ABDOMEN :

free fluid

specific organ injury

CT SCAN : GRADING OF INJURY
EXPECTED LINE OF MANAGEMENT:

Purely conservative

Needs constant observation and delayed surgery if indicated

Purely surgical

OPERATIVE PROCEDURE
ANESTHESIA

INCISION

FINDING

SPLENECTOMY OR SPLENORRHAPHY

BLOOD TRANSFUSION:
POST OPERATIVE PERIOD
Uneventful

Complicated

Nature of complication

CONDITION AT DISCHARGE

FOLLOW UP:

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MASTER CHART

S.NO	NAME	AGE/ SEX	IPNO	D.O.A	TIME INTERVAL BETWEEN INJURY	D.O.S	D.O.D	MODE OF INJURY	GRADE OF INJURY	OTHER ORGAN INJURY	MANAGEMENT	DURATION OF HOSPITAL	COMPLICATION	DEATH
1	SEETHA	25/F	12234	2/11/11	3	2/11/11	17/11/11	RTA	4	-	SPLENECTOMY	15	WOUND INFECTION	-
2	RAM	29/M	2343	10/10/11	1	-	18/10/11	RTA	1	-	CONSERVATIVE	8	-	-
3	RANI	32/F	45765	3/10/10	2	3/10/10	22/10/10	FALL FROM HEIGHT	5	BOWEL PERFORATION	SPLENECTOMY	19	OPSI	×
4	ARUN	35/M	5432	7/7/11	30	9/7/11	15/7/11	RTA	3	-	SPLENORHAPHY	8	-	-
5	ARAVINDH	26/M	56098	5/10/10	6	5/10/10	6/10/10	RTA	2	BOWEL PERFORATION	SPLENORHAPHY	30	ATELECTASIS	-
6	KAMATCHI	24/F	87645	1/1/12	25	-	12/1/12	FALLOF HEAVY OBJECT		-	CONSERVATIVE	11	-	-
7	RAJKUMAR	44/M	98567	7/5/12	2	7/5/12	17/5/12	RTA	4	LIVER INJURY	SPLENECTOMY	10	OPSI	×
8	MOHAN	36/M	76534	4/7/12	4	-	19/7/12	RTA	3	-	CONSERVATIVE	15	-	-
9	SANTHOSH	17/M	9999	5/6/11	3	-	3/7/11	FALL FROM HEIGHT	2	ORTHO	CONSERVATIVE	28	-	-
10	SEKAR	33/M	6546	9/8/11	9	9/8/11	27/8/11	RTA	5	-	SPLENECTOMY	18	WOUND INFECTION	-

11	LAKSHMI	55/F	86655	8/8/11	5	-	14/8/11	FALL FROM HEIGHT	1	HEAD INJURY	CONSERVATIVE	6	-	×
12	MANIVEL	62/M	9861	6/3/11	3	6/3/11	28/3/11	RTA	4	-	SPLENECTOMY	22	ATELECTASIS	-
13	SURESH	28/M	7777	4/9/10	6	5/9/10	9/9/10	FALLOFHEAVY OBJECT	5	THORAX INJURY	SPLENECTOMY	35	WOUND INFECTION	-
14	SELVI	43/F	6099	4/4/12	14	-	14/4/12	KICKBYANIMAL	2	-	CONSERVATIVE	10	-	-
15	KARTHIK	18/M	4388	5/5/12	7	-	22/5/12	RTA	3	-	CONSERVATIVE	17	LEFT SUBPHRENIC ABSCESS	-
16	MURUGAM	22/M	54323	5/4/11	3	5/4/11	30/4/11	RTA	5	-	SPLENECTOMY	25	-	-
17	KAILAHSAM	52/M	33334	9/5/12	10	10/5/12	9/5/12	FALLOFHEAVY OBJECT	2	-	SPLENORHAPHY	9	-	-
18	MANI	48/M	22225	2/8/10	11	-	12/8/10	FALL FROM HEIGHT	2	THORAX INJURY	CONSERVATIVE	10	-	-
19	RAVI	34/M	77668	3/1/11	2	4/1/11	23/1/11	RTA	4	-	SPLENECTOMY	20	LEFT SUBPFRENIC ABSCESS	-
20	RASU	45/M	55997	4/8/12	13	5/8/12	16/8/12	FALL FROM HEIGHT	3	-	SPLENORHAPHY	12	-	-

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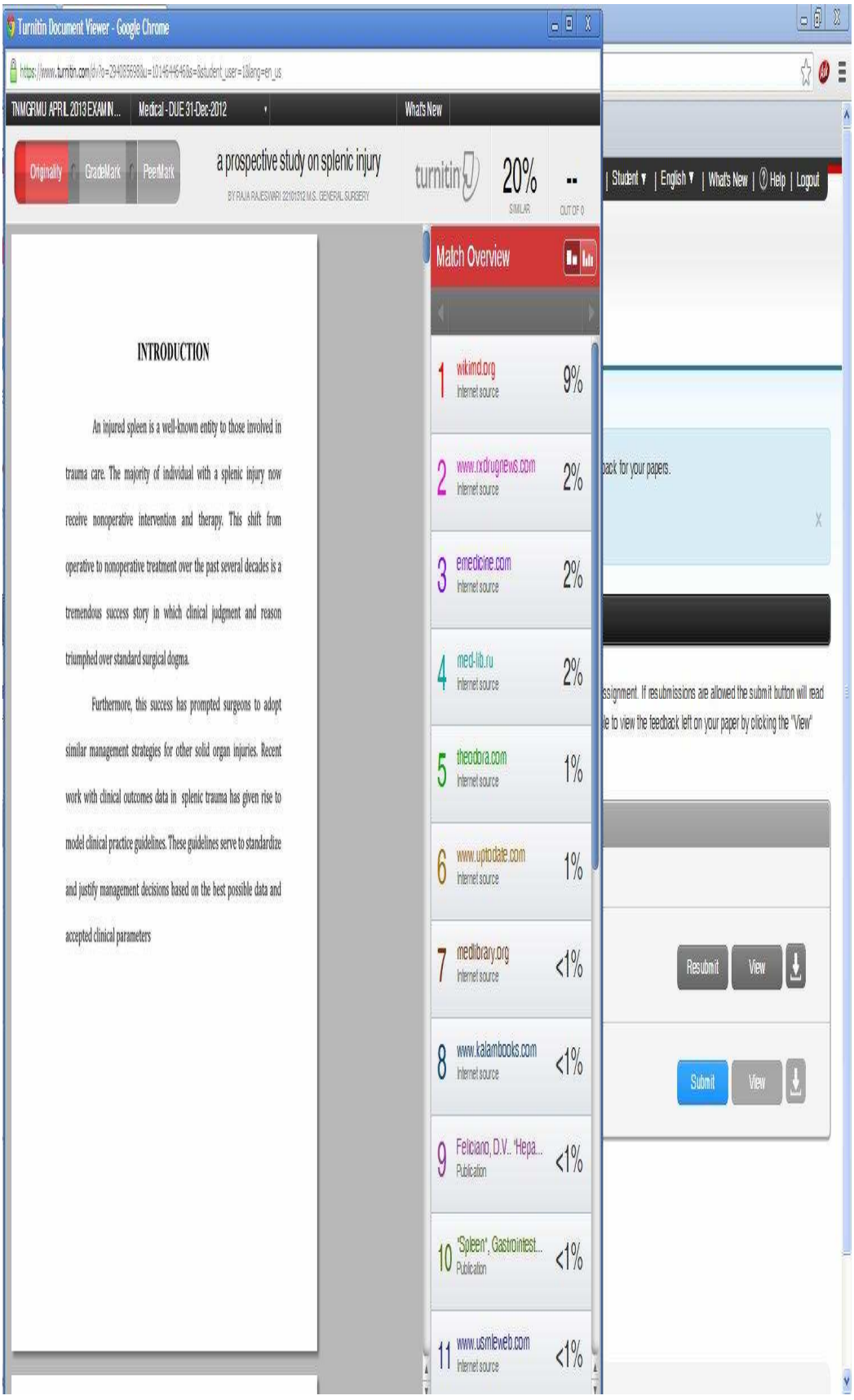
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INTRODUCTION
An injured spleen is a well-known entity to those involved in trauma care. The majority of individual with a splenic injury now receive nonoperative intervention and therapy. This shift from operative to nonoperative treatment over the past several decades is a tremendous success story in which clinical judgment and reason triumphed over standard surgical dogma.
Furthermore, this success has prompted surgeons to adopt similar management strategies for other solid organ injuries. Recent work with clinical outcomes data in splenic trauma has given rise to model clinical practice guidelines. These guidelines serve to standardize and justify management decisions based on the best possible data and accepted clinical parameters
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